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(19)

(54) WHEEL SET SUSPENSION SYSTEM FOR CHASSIS FRAMES, MORE PARTICULARLY BOGIE FRAMES, OF RAIL VEHICLES

(71) We, THYSSEN INDUSTRIE AKTIENGESELLSCHAFT, of Am Rheinstahlhaus 1, D-4300 Essen, Federal Republic of Germany, a Joint-Stock Company organised under the laws of the Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

This invention relates to a wheel set suspension system for cassis frames, more particularly bogie frame, of rail vehicles, wherein each wheel set bearing housing is connected to the chassis frame or bogie frame through the intermediary of spring elements in the vertical, horizontal longitudinal and horizontal transverse directions.

An accurately tuned suspension of the wheel sets with reference to the chassis frame or bogie frame in the vertical, horizontal longitudinal and horizontal transverse direction is necessary, for rail vehicles travelling at high speeds, in order firstly to ensure maximum travelling safety for low stressing of the vehicle components and the tracks, and secondly in order to achieve quiet running of the vehicle.

In suspensions of wheel set bearing housings, helicoidal springs, leaf springs or rubber springs are generally used for the vertical suspension and the flexicoil effect of helicoidal springs or the transverse elasticity of rubber springs for the horizontal transverse suspension. In a known suspension system for a chassis frame or bogie frame, a torsion bar arranged in the longitudinal direction of the chassis or bogie frame, which is attached to a cam sleeve located above the axle bushing, the cams of which are braced against the axle bushing, serves for the suspension in the vertical direction (DT-PS 803714). It is further known for the horizontal longitudinal suspension and guidance to provide rigid guide rods (DT-AS 2 029 329) or guide rods mounted elastically in rubber bushings (GB-PS 780 783).

It is a disadvantage of these constructions that by determining the spring constants for the suspension in one direction, the spring constants in another direction or in both other directions are firmly mutually associated by the selection of the spring elements and it is therefore difficult simultaneously to adjust the optimum spring constants in the vertical, horizontal longitudinal and transverse directions. The exchange of one or more spring elements simultaneously is necessary for the purpose of adjusting the spring constants in each case. Furthermore, the said spring elements require wheel set bearing houses of correspondingly complicated configuration for their attachment, which increase the unsprung mass of the wheel set, which is unfavourable especially in chassis or bogie frames of modern high-speed rail vehicles.

The invention aims at developing a suspension system of the foregoing kind, wherein the spring constant of the spring elements, and hence the rigidity values of the vertical as well as the horizontal longitudinal and horizontal transverse suspension can be influenced and which serves simultaneously for guiding the wheel set bearing housing. It is a further aim of the invention, by a simply conformed attachment of the spring elements to the wheel set bearing housings, to reduce their unsprung mass and hence that of the wheel sets.

The present invention accordingly consists in a wheel set suspension system for chassis frames, more particularly bogie frames, or rail vehicles, wherein each wheel set bearing housing is connected to the chassis or bogie frame through the inter-

mediary of spring elements in the vertical, horizontal longitudinal and horizontal transverse directions, characterised in that the spring elements of at least the vertical and horizontal transverse directions are torsion bars, the rigidity of which is dictated mutually independently by appropriate selection or is adjustable in that each torsion bar is on the one hand clamped non-rotatably but with axial sliding movement in a reaction lever arranged for longitudinal sliding movement on the chassis or bogie frame, and on the other hand is connected by a rocker lever and a guide rod or thrust rods to a bearing housing of the wheel set.

Advantageously, two torsion bars for the vertical suspension and one torsion bar for the horizontal transverse suspension are arranged in the longitudinal direction of the chassis or bogie frame (e.g. inside or outside the longitudinal frame member) and the torsion bar for the horizontal longitudinal suspension is arranged in the transverse direction of the chassis or bogie frame. With appropriately selected rigidity each torsion bar may be of thickened construction at its junction points for the reaction lever and the rocker lever. In order to reduce production cost it is recommended that reaction lever and/or rocker lever be formed by angling the torsion bar.

In the case of adjustable spring rigidity the torsion bars are of prismatic cross-section so that the reaction levers may be moved in longitudinal direction of the torsion bars without loosening the torque-transmitting engagement.

An embodiment wherein the torsion bars are composed of individual elements arranged parallel is characterised by high inherent damping.

The advantageous achieved by the invention are more particularly that the suspension system can be used for chassis or bogie frames with longitudinal members arranged both above and below the wheel set bearing housings.

In order that the invention may be more readily understood, reference is made to the accompanying drawings which illustrate diagrammatically and by way of example, embodiments thereof, and in which: —

Fig. 1 is a side elevation of a wheel set suspension system with torsion bars and helicoidal springs arranged in the direction of travel;

Fig. 2 is a section on the line A-A of Fig. 1;

Fig. 3 is an end elevation of the suspension system according to Fig. 1, with some components removed; and

Fig. 4 is a plan view of a suspension system with torsion bars arranged in and transversely to the direction of travel.

In the wheel set suspension system according to the invention, two torsion bars 1 for the suspension in the vertical direction, and a torsion bar 7 for the suspension in the horizontal transverse direction, are arranged juxtaposed and mutually staggered in the longitudinal direction of the chassis frame or bogie frame 22. Each torsion bar 1 and 7 is firmly attached by its one end to a rocker lever 2 or 8, which communicates with the wheel set bearing housing 24—depending on whether the longitudinal frame member is arranged above or beneath the wheel set bearing housing 24—either through the intermediary of traction rods 4, guide rods 10, 21 or thrust rods (not shown), whilst its other end engages an abutment constructed as a reaction lever 3 or 9. With appropriate selection of the rigidity, the torsion bars are fixed to their reaction levers. In the case adjustable spring rigidity is desired, the torsion bars are arranged with axial sliding movement in their reaction levers (not shown) and the latter are in turn mounted with longitudinal sliding movement in the chassis or bogie frame 22, so that an effective torsion bar length corresponding to the desired spring rigidity can be adjusted.

As shown more particularly in Fig. 2, the torsion bars 1 serving for the vertical suspension are braced in the region of their rocker levers 2 in stationary bearing blocks 6 which are fixed to the longitudinal frame member and are preferably located inside the longitudinal member. Due to the division of the vertical springs into two equal torsion bars 1, the oppositely directed torques cancel each other and the longitudinal member has only to transmit the torque from the transverse suspension into the transverse member or members of the chassis or bogie frame. This construction is particularly advantageous for chassis or bogie frames with longitudinal members extending beneath the wheel set bearing housings. Shock absorbers 5 for damping the vertical oscillations are located in front of and behind the wheel set bearing housing 24, considered in the longitudinal direction of the chassis or bogie frame, and are fixed to it and to the longitudinal frame member located beneath it (Fig. 2). It is also possible to use only one torsion bar for the vertical suspension if required.

The torsion bar 7 of the horizontal transverse suspension is preferably located outside the longitudinal frame member and engages into a tube 13 which is mounted rotatably in two stationary bearing blocks 12 likewise fixed to the longitudinal member and is connected by two rocker levers 8 to the wheel set bearing housing 24.

With such an arrangement of the torsion bars, the cover of the wheel set bearing housing 24 is freely accessible. This is also achieved by the use of two torsion bars for the horizontal transverse suspension.

In order to damp transverse oscillations, the tube 13 into which the torsion bar 7 engages is attached to a shock absorber 11 which is connected by one end through a rocker lever 26 and a tube 25 to the tube 13 and at its other end to a bearing block, not specifically designated, fixed to the longitudinal frame member.

The suspension in the horizontal longitudinal direction is obtained in the embodiment according to Figs. 1 to 3 by two helicoidal springs 14 which are braced by their outer ends against discs on the shock absorber 17 and by their inner ends against an abutment 16 present on the chassis or bogie frame 22. The oscillations are damped by the shock absorber 17 arranged inside the springs 14, which is articulated by one end to the chassis or bogie frame 22 and connected at its other end by distance pieces 15 to the wheel set bearing housing 24.

In the embodiment illustrated in Fig. 4, the suspension in the horizontal longitudinal direction is provided, instead of the helicoidal springs 14, by a torsion bar 18 which engages by its one end in a reaction lever 20 arranged on the transverse frame member and transmits the torque through a rocker lever 19 and a guide rod 21 attached thereto and distance pieces 15 to the wheel set bearing housing 24. A shock absorber 27 is attached preferably to the rocker lever 19 by its end confronting the wheel set bearing housing 24.

Each torsion bar 1, 7 and 18 may, in manner known *per se*, consist either of solid or hollow profile and have a circular or polygonal cross-section or a cross-section composed of a plurality of mutually superposed individual elements.

The reference numeral 23 designates an air spring which is arranged between the chassis or bogie frame 22 and the vehicle body (not shown).

WHAT WE CLAIM IS:—

1. A wheel set suspension system for chassis frames, more particularly bogie frames, of rail vehicles, wherein each wheel set bearing housing is connected to the chassis or bogie frame through the intermediary of spring elements in the vertical, horizontal longitudinal and horizontal transverse directions, characterised in that the spring elements of at least the vertical and horizontal transverse directions are torsion bars, the rigidity of which is dictated mutually independently by appropriate selection or is adjustable in that each torsion bar is on the one hand clamped non-rotatably but with axial sliding movement in a reaction lever arranged for longitudinal sliding movement on the chassis or bogie frame, and on the other hand is connected by a rocker lever and a guide rod or thrust rods to a bearing housing of the wheel set.

2. A wheel set suspension system as claimed in claim 1, wherein two torsion bars for the vertical suspension and one torsion bar for the horizontal transverse suspension are arranged in the longitudinal direction of the chassis or bogie frame (e.g. inside or outside the longitudinal frame member) and the torsion bar for the horizontal longitudinal suspension is arranged in the transverse direction of the chassis or bogie frame.

3. A wheel set suspension system as claimed in claim 1 or 2, wherein each torsion bar is of thickened construction at its junction points with the reaction lever and the rocker lever.

4. A wheel set suspension system as claimed in any of claims 1 to 3, wherein the torsion bars are constituted by parallel arranged individual elements.

5. A wheel set suspension system as claimed in claim 1 and any of claims 2 to 4, wherein reaction lever and/or rocker lever is produced by angling the torsion bar.

6. A wheel set suspension system as claimed in any of claims 1 to 5, wherein the wheel set bearing housing is connected to the chassis or bogie frame directly by shock absorbers arranged in the vertical direction and indirectly by shock absorbers arranged in the horizontal longitudinal direction.

7. A wheel set suspension system as claimed in any of claims 1 to 6, wherein a longitudinal member of the chassis or bogie frame is connected to a tube for the torsion bar located outside the longitudinal frame member by a shock absorber in the horizontal transverse direction which is operatively associated with said tube through a rocker lever.

8. A wheel set suspension system substantially as herein described with reference to and as shown in Figs. 1 to 3 or Fig. 4 of the accompanying drawings.

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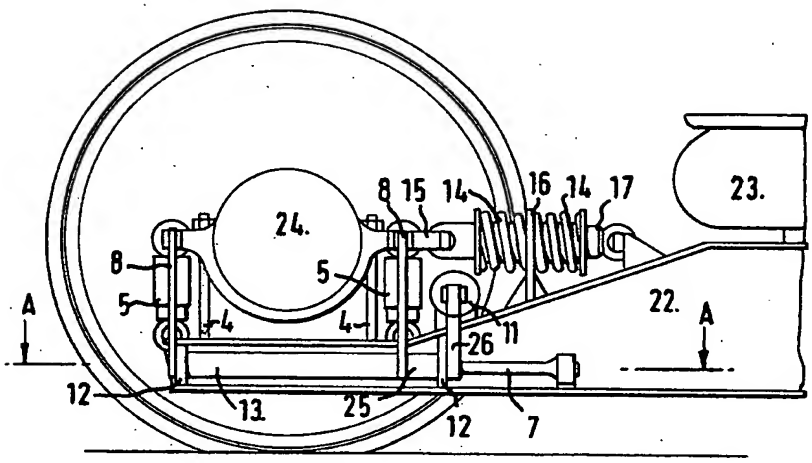

FIG.1

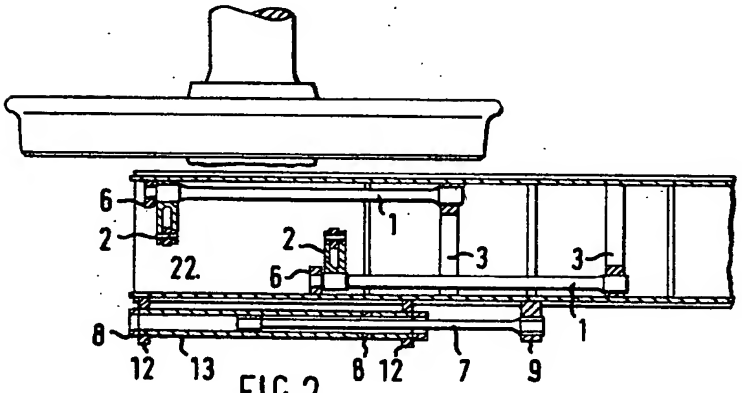

FIG.2

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

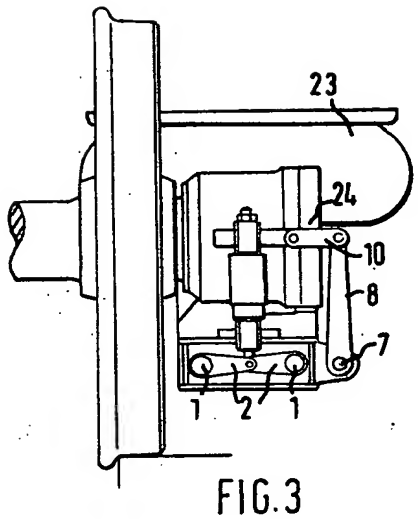

FIG.3

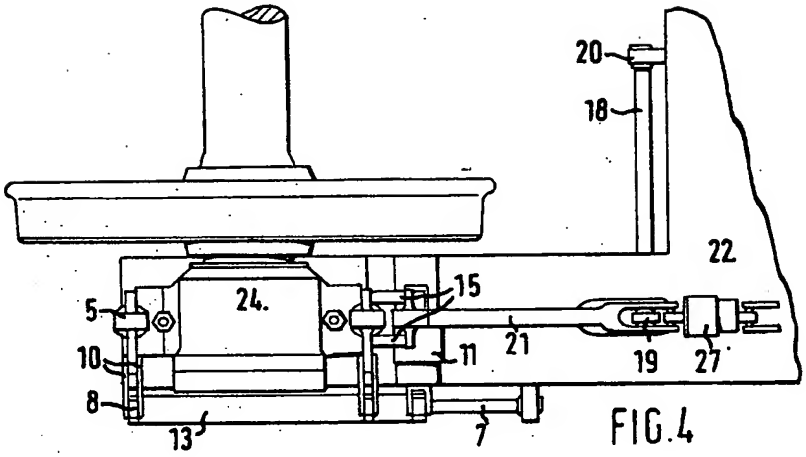

FIG.4